DOCUMENT RESUME

ED 021 431 EF 001 894

ILLUMINATING ENGINEERING RESEARCH INSTITUTE ANNUAL REPORT 1967. A REVIEW OF PROJECT ACTIVITIES AND A ROUNDUP OF IERI RESEARCH INTERESTS.

Illuminating Engineering Research Inst., New York, N.Y.

Pub Date 67

Note-37p.

EDRS Price MF-$0.25 HC-$1.56

Descriptors-*LIGHTING, *PHYSICAL ENVIRONMENT, *RESEARCH, *RESEARCH PROJECTS, *VISUAL PERCEPTION

Presented in this report are the Illuminating Engineering Research Institute's fundamental scientific concepts in a new frame of realism while relating them to an up-to-date accounting of the search for new basic knowledge. In addition to being an annual accounting, it is also intended to provide orientation. Its presented in dramatic and simplified form, and to develop a view into how the march of progress has influenced thinking, action and planning among light and vision scientists. Research projects elaborated on are--(1) visual performance and illumination, (2) roadway visual tasks, (3) color preference studies, (4) glare from large sources, (5) discomfort glare data analysis, (6) transitional adaptation, (7) standardized test objects, and (8) polarization of light. Photographs and drawings are included. (RK)

# 1967 ANNUAL REPORT





ILLUMINATING
ENGINEERING
Research Institute

**A review of project activities and a roundup of IERI research interests**

# INDEX

Page



The two-part cover presentation in this year's report is representative of the Illuminating Engineering Research Institute's interest in man's growth in his growing world.

# ANNUAL REPORT 1967

## A REVIEW - AND A ROUNDUP OF IERI RESEARCH INTERESTS

Are you a longtime supporter of the Illuminating Engineering Research Institute? If you are, you will recall discussions of quantity and quality of lighting in earlier annual reports, and you might be familiar with the idea of figurative Man progressing from the simplicity of a figure in space to his place in the complexitites of the modern world, as suggested by the cover design. For you this report presents the Institute's fundamental scientific concepts in a new frame of realism while relating them to an up-to-date accounting of the search for new basic knowledge.

If you are one who has only relatively recently joined the roster of the IERI, this report, in addition to being an annual accounting, is intended to provide orientation. We hope that through it you will sharpen your interest in the scientific concepts of lighting that we attempt to present here in dramatic and simplified form and that you will emerge with a better view of how the march of progress has influenced thinking, action and planning among light and vision scientists.

Many of us, unfortunately, take change for granted. Some of our leading sociologists, anthropologists and ecologists warn us that we shouldn't. In the days before our new Scientific Revolution, they point out, "when a man felled trees to build a house, or shot a deer, or laid rails across the plains, he knew the result of what he was doing"...He was only lightly changing the vast pattern of nature -- subtracting three from five, so to speak. "There were not enough of him, nor was the power of his science great enough to upset the ecological balance in which man himself lived....

"Now that has changed. When we alter our urban environment, we are changing a system that has been stable for a great period of time. We are changing an extension of ourselves that is in the process of rapid, complex growth, and about which we have a limited understanding..."[1]

In the IERI we are tuned-in on change. We recognize the need to understand it, to link with it so that we can bring its benefits to our special area of interest -- more efficient and comfortable seeing conditions and pleasing reactions to the surroundings in our fast-moving world. This is not an easy assignment. Why? Simply because in the course of this rapid and complex growth we have not always improved our scene in all respects. In some instances we have complicated it with a vast assortment of the paraphernalia of modern living. In lighting, in fact, we have added to rather than detracted from the conditions that hamper our ability to see the tasks we must perform in order to live.

In the beginning -- in our least complicated era -- Man could be easily pictured in a simple state of living. But his conditions -- as we shall show pictorially a little later on -- changed drastically as he grew to occupy the rectangular rooms that protect him from the

---

1. Adapted from Lewis Mumford.

IN THE BEGINNING -- Here man is pictured in his simplest environment: in an envelope in which light is approaching him from all angles. His environment gradually became more complicated as he surrounded himself with the settings of modern living.

elements but that surround him with new bright surfaces with walls and ceilings and floors, and with desks and machines and printed materials, all with the ability to reflect light, often to his detriment.

And he hasn't yet stopped adding to these drawbacks. Only in recent years he has widened his conventional windows to occupy an entire exterior wall so that his building might have a modern line and perhaps be less costly to build; he has made night as well as day a time for work, for living out of doors and for making profitable and useful the million miles of highways, airport runways and sports fields and arenas he has built.

As members of the American scene, we have learned not to quarrel with progress.

But, as lighting engineers, in keeping abreast of progress, we must recognize that Man, in expanding his commercial proficiency, in developing his shiny modern world and in proliferating his sources of comfort and pleasure, has actually interfered in at least two important ways with the functioning of the marvelous machinery with which he sees -- his eyes, his nervous system and his brain.

First he has brought more of his prime sources of brightness into his living areas -- the brightness of the sun and sky, for example, through his glass walls.

Second, he has developed additional brightness problems from the equipment with which he has surrounded his life. He has developed interfering or glossy reflections from some of his gadgetry, as we have already mentioned. Additonally he has caused an absence of useful brightness through the use of dark woods in his furnishings and dark paneling in his room decorations.

And, with both of these conditions he is competing with the brightness that reaches his eyes from the surface of the task itself, the brightness he must see effectively if he is to perform the task effectively.

In the parlance of the light-and-vision scientist, Man has created for himself the problem of glare -- a condition that is sometimes just uncomfortable to vision and sometimes actually disabling. And he has further made it necessary for research scientists first to discover how to control this brightness problem and then to discover how to compensate for its interferences.

In these two facts are the roots of IERI interest in both the quantity and quality of light -- the reasons for its dedicated search for answers to this question: "How much of what kind of illumunation does Modern Man need to light his workaday environment?"

As significant illustrations, here are a few ways in which quantity and quality bear on effective vision

## QUANTITY

Among their basic studies, IERI researchers have established that the eye accumulates facts by darting from one section of the seeing task to another. The more complex the task, or the less the contrast of the task against its background, the more frequent are the darts -- unless the lighting level is raised. If an element of motion is added to the task -- the action of automobiles moving toward each other on a highway, for example -- the prescription for effective lighting must again be altered.

Still other qualifications are introduced if, by chance, lighting a stadium is the problem. Here the lighting level established must meet a double objective: it must enable the spectators to follow the action without interruption, and it must also enable the players easily to follow the ball or puck.

## QUALITY

Level of illumination is only part of the formula to assure effective seeing. Because glare and sharp differences in brightnesses frequently hamper viewing the task, quality of light plays a role equally as important as quantity.

Adjustment of the lighting formula can reduce the effects from both types of glare -- discomfort glare in which the pupil of the eye closes down in the presence of over-brightness, and disability glare in which stray light from bright sources causes a veiling haze to be laid over the image registered inside the eye.

IERI studies have also played an important role in a related area of vision -- in evaluating the loss of the eye's ability to see as it moves from a light to a darker area of view, or vice versa. Adjustment of the lighting formula, it has been found, also can overcome or minimize this loss.

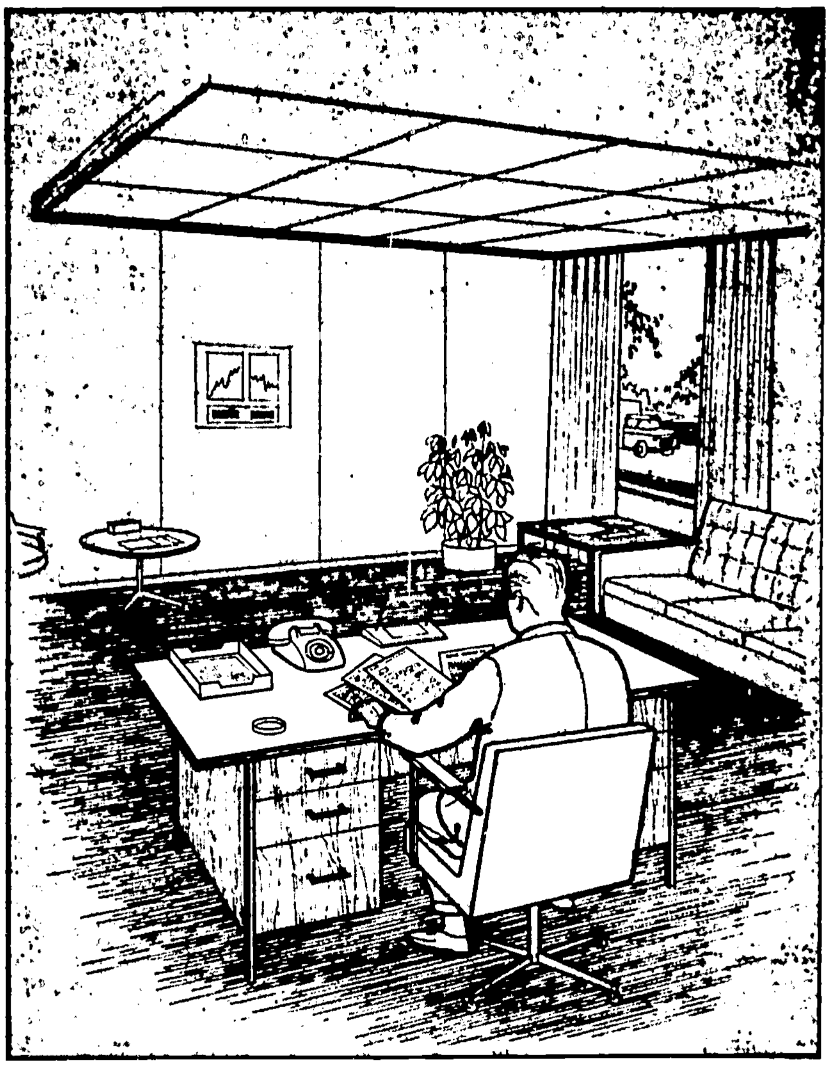
Also important in the area of quality is the problem of specular reflection which occurs when the light from an overhead luminaire is reflected back to the eye of the viewer. This is caused by tiny mirror reflections from the surface and the details on the paper and can be seen only under magnification. The effect can be corrected by spreading the light source so that more comes from wider angles outside of the viewing zone. Also, polarization has a partial role to play.

Finally, the use of various types of illumination in conjunction with pre-tested combinations of colors is an important and promising contribution to the environmental function of lighting, providing mood, emotional relaxation and grace of line.

Now, how has the IERI acted to probe more deeply into vision problems as we know them? Let's look at a series of pictures of typical office scenes where many of the principles of effective lighting and seeing -- and many examples of our problems -- are readily at hand:

## AMOUNT OF LIGHT ON THE TASK

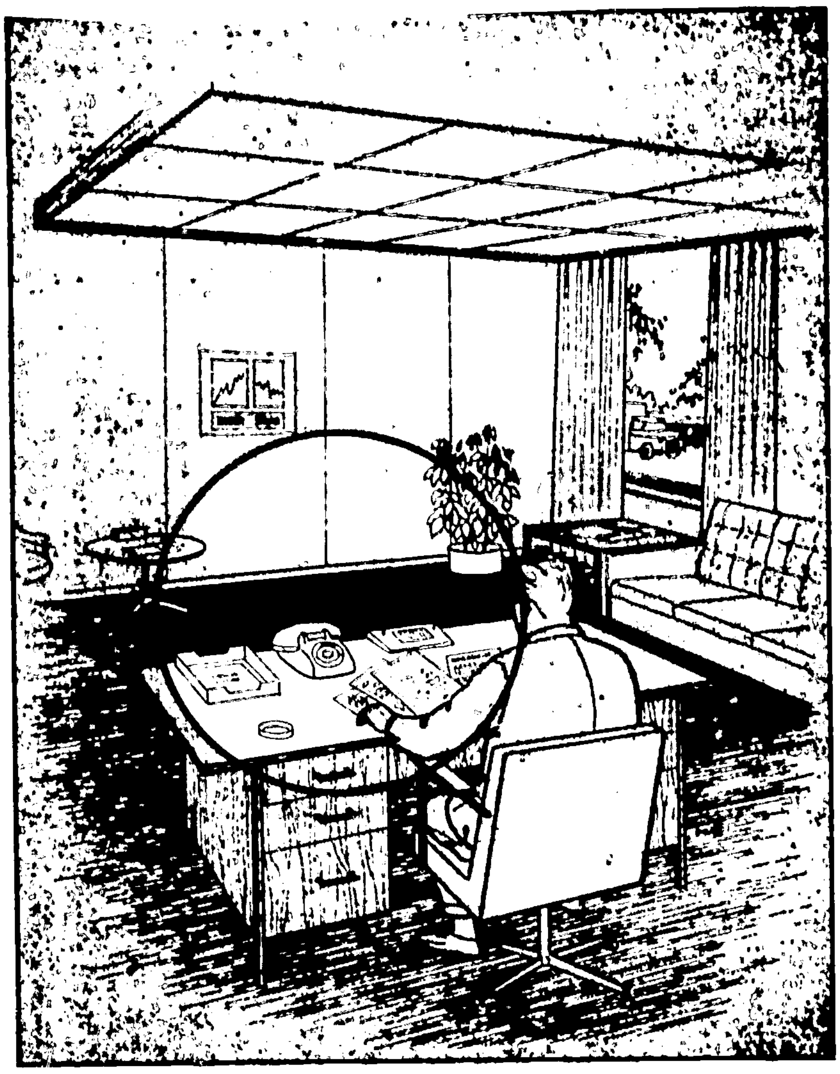
1. The eye utilizes a scanning pattern in gathering information to transmit to the brain in viewing a task in an office, a schoolroom, a manufacturing plant or at home in the course of simple chores and even relaxation. Facts that light-and-vision scientists are revealing relate increased complexity of patterns to need for increased light. Dr. Stanley Smith at the Ohio State University is the researcher in this field. His Project, 30-66 A, is reported on Page 18 .



## OLDER AND SUBNORMAL EYES

2. A great mass of practical knowledge on the light-and-sight relationship has been developed since the end of World War II. All has been based, however, on studying young, normal eyes. Evidence suggests that older persons and persons with subnormal vision require more light than do young normals. Mrs. O. M. Blackwell, also at Ohio State, is studying this in Project 30-66 B. A review is on Page 20 .

# BRIGHTNESS DIFFERENCES



3. In working at a desk or in fulfilling most seeing tasks the viewer occasionally will involuntarily look away to another area of view. If the new level of brightness is markedly different from that of the task, there is a temporary loss of ability to see. At the University of Rochester Dr. Robert M. Boynton is studying details of this condition. A summary of recent work is on Page 24 .

# EFFECT OF DISCOMFORT GLARE

4. Striking losses in visibility occur when, under certain conditions, reflections from overhead lighting units in schools and offices veil the viewing task. Basic facts were revealed in an early IERI study. Now losses are being measured by Dr. H. Richard Blackwell at Ohio State (See Project 70 AS-4£5 on Page 26 ) and methods of improving quality are soon to be examined by Prof. Marion Currie at the University of Toronto

## REFLECTIONS VEILING THE TASK

5. Large areas of lighting frequently are required to perform a viewing task effectively. These large sources of brightness, particularly from daylight entering broad, clear windows and from luminous ceilings and walls, often cause discomfort glare. How to control this condition has been studied at Cornell University and the results are now being analyzed by Dr. Ralph G. Hopkinson at the University of London under Project 59-66 which is reported on Page 22 .

## PLEASANTNESS OF INTERIORS

6. Lighting for effective vision might not itself provide a pleasant, colorful living environment. Color schemes, however, can overcome blandness and improve the attractiveness of the scene. Dr. Harry Helson has studied the question in depth under Project 48 and has issued a tentative report including assorted combinations of colors and backgrounds. Status of his finished paper is reviewed on Page 21 .

## PARTNERSHIP OF LIGHT AND HEAT

7. Increased brightness levels required for improved seeing incidentally is producing increased energy, particularly increased amounts of invisible heat. Efficient use of the total energy output from lighting, including its use as a heating element, is an important area for IERI investigation which is soon to be begun.

# YEAR IN REVIEW

VISUAL PERFORMANCE AND ILLUMINATION (Project 30 - 66) This project is being conducted in two parts. Dr. Stanley Smith is studying the complications created by movement in the course of field viewing. He expects to relate laboratory data more closely to field situations. In the second part, Mrs. O.M. Blackwell is studying the decline of visual performance in the aging. She has been concentrating on the contribution that the increase of ocular stray light makes to this decline.

ROADWAY VISUAL TASK (Project 47 - 66). Mrs. Blackwell has also been the active investigator in this study, establishing the varying visibility factors of four different U.S. and European methods of distributing light on a roadway.

COLOR PREFERENCE STUDY (Project 48). Dr. Helson's study, for which a final report is currently being prepared, has been found to be meaningful.

GLARE FROM LARGE SOURCES. (Project 59 - 66). Results of experiments at Cornell University are being analyzed and correlated in England where these studies originated.

DISCOMFORT GLARE DATA ANALYSIS (Projects 59 AS 1&2, and 3 & 4.) Dr. Glenn Fry is analyzing research data from American, British and European studies and attempting to reconcile results. Dr. Charles Marsh has developed a photographic method of determining average and maximum brightness of luminaires.

TRANSITIONAL ADAPTATION (Project 63 - 66) Dr. Robert Boynton at the University of Rochester, in the third of a protracted series of tests, is conducting a "running tau" experiment in which he is attempting to determine the visibility loss due to exposure to brightness.

STANDARDIZED TEST OBJECTS (Projects 70 AS 4 & 5). Dr. H.R. Blackwell and his staff have introduced extremes in lighting into their studies aimed at determining contrast losses in printed and handwritten tasks in offices and schools.

GLARE REDUCTION BY POLARIZATION (Project 78 - 66). A photographic procedure at the University of California at Los Angeles makes possible the measurement of polarization effects on various parts of the seeing task.

FOURTH IERI SYMPOSIUM -- Basic visual functions and practical lighting problems were the concern of lighting experts from England, the Continent and the United States at the 4th International Symposium of the IERI which was conducted in this fiscal year at Ohio State University.

# Visual Performance and Illumination

**PROJECT 30**

This project is still being conducted in two parts, as previously reported. Dr. Stanley Smith at Ohio State University is carrying on Section A which is a laboratory study of the elements involved in field seeing by normal observers. Mrs. O. M. Blackwell, also at Ohio State, is conducting Section B which is a study of the effects of age on lighting requirements.

**PROJECT 30 A-66**

Contrast detection is fundamental to visual effectiveness in studying performance in field situations. Determining the extent to which movement -- of the eyes or of the task -- complicates viewing and decreases effective performance has been occupying Dr. Smith for many months.

These studies, in the end, will serve to relate laboratory data more directly to field situations. They are of particular importance because they will show how much increase in the level of illumination is required to compensate for the extra time and searching the eye requires to view a dynamtic rather than a static seeing task.

Dr. Smith has approached this problem with three factors under consideration:

1. First he is concerned with the direction of gaze or the location of the image on the sensitive inner surface of the eye.

2. Secondly he is concerned with the amount of time the detail is maintained in view,

3. And, thirdly, he is interested in the amount of time the eye is actually in movement and therefore not fixed on the critical detail.

Dr. Smith is continuing with his eye-marker studies which record and measure the directional movements of the eye on the calibrated screen of a closed-circuit television system. He has discovered, however, that there is a "slippage" or an area of inaccuracy in his monitoring of head-pointing which is registered on the TV screen as a sharp point of light (superimposed on the field image) created by combining two signals from the horizontal and vertical components of two photo cells trained on the left eye.

While attempting to correct this deficiency, Dr. Smith is proceeding with portions of his study in which head-pointing does not play a role and in which free head movements are undesirable. For this work, Dr. Smith has designed a bite bar which keeps the head of the observer in a constant position in relationship to the field of view. He reports that his temporarily limited range of work is producing highly useful data that is remarkably sensitive and reliable.

Dr. Smith reports that one result from his latest tests is an indication that performance deteriorates as the time available for redirecting the eye's attention to a new viewing point is decreased.

PROJECT 30 B-66

In the second part of the project, Mrs. Blackwell has concentrated her studies during the year under review on the increase of ocular stray light as one of the factors causing a decline in visual performance in aging. The increase in ocular stray light, she finds, is due to the aging eye's tendency to disperse rays of light as fog does, and to cause veiling brightness to overlay the image.

Although some phases of Mrs. Blackwell's work have been delayed by the absence of essential testing equipment, the studies she has been able to carry forward -- despite the need to confine herself to small samplings of subjects -- have indicated that visual performance definitely decreases with age, particularly at luminances related to inferior lighting. In addition to the effect of ocular stray light, factors that are believed to contribute to the decline in visual performance at older ages, but which are not presently within the boundaries of the studies, are:

1. Reduction of pupil size
2. Degraded optical imagery
3. Increasingly inaccurate fixation.

## Roadway Visual Tasks

PROJECT 47-66

Mrs. Blackwell has been the active investigator on this on-going study of lighting requirements for roadway viewing-tasks, a project in which the Ohio Department of Highways and the U. S. Bureau of Public Roads are also concerned.

Her studies showed varying visibility factors from four different methods of distributing light on the roadway.

A cut-off type of distribution, which is similar to the system of luminaire lighting used in Europe, presented large variables in visibility in her studies. On the other hand, a continuous line of luminaires, used in the same circumstances over the same pavement, produced fairly uniform visibility.

Mrs. Blackwell indicated that non-cut-off luminaires, more nearly approximating those widely used in North America, soon would be introduced into her studies. Also, she has said that instruments would be improved and mechanized. These changes would tend to broaden the scope of results.

Plans to extend measurements of roadway visibility in fog were delayed, she reported, because fog-making equipment, used in studies several years ago, proved to be inoperable. Pipes had become corroded and temporary replacement seemed uneconomic inasmuch as a new Highway Simulator is to be built, including plastic tubing for fog-making, under a contract expected soon from Washington.

## Color Preference Studies

**PROJECT 48**

While awaiting a final report from Dr. Harry Helson, who has moved his center of operations from Kansas to York University, Toronto, Canada, IERI officials have tested initial and still tentative findings in rating published color photographs and have found them to be meaningful.

SIMULATED HIGHWAY -- View along a model highway set up in the laboratories of IERI researchers at Ohio State University to duplicate lighting conditions and obstacle visibility of a local street.

# Glare from Large Sources

**PROJECT 59-66**

The study of glare from large sources, familiar over the years to those who have watched IERI reports, has been carried foward at both the Building Research Station in Garston, England, and at Cornell University, Ithaca, N. Y. Results of the American tests on multisource glare (see Pages 20 through 22 in the 1966 Annual Report) are now being correlated and analyzed in England by Wendy Collins and Dr. Ralph G. Hopkinson.

Conclusions resulting from this analysis are expected in the near future.

## Discomfort Glare Data Analysis

**PROJECT 59 AS.1&2**

Dr. Glenn A. Fry at Ohio State University, Columbus, is also analyzing research data from British, American and European studies of direct discomfort glare, but has not completed the task. Freed from administrative duties in his new capacity as Regents Professor at the university, Dr. Fry expects to pursue this work diligently. He expects, however, that he will have to devise additional experiments to reconcile differing results.

**PROJECT 59 AS 3**

This is another discomfort glare activity, Isaac Goodbar attempting to develop a chart or charts to indicate whether a given luminaire system is measuring up to a given degree of comfort for offices and schools. The project was delayed when Mr. Goodbar observed a technical complication in the basic formula which suggested that more glare was present when fewer lights were used in large rooms.

**PROJECT 59 AS 4**

Prof. Charles Marsh of Pennsylvania State University, an IERI investigator in the early studies of lighting through highway fog, has developed a photographic system of determining average brightness as well as maximum brightness of luminaires. New work on the project proposes to use an electronic scanner.

# Transitional Adaptation

**PROJECT 63-66**

A series of three studies on transitional adaptation has been conducted over the past nine years at the University of Rochester (N. Y.) by Dr. Robert M. Boynton, psychophysicist and director of the school's Center for Visual Science. The objective of the series is to determine how an increase or decrease in luminance level or brightness will affect the subject's ability to see.

Dr. Boynton's first set of experiments, covered in the IERI's 1964 annual report, was concerned with the action of the eye when it was directed from one to another seeing task of either greater or lesser

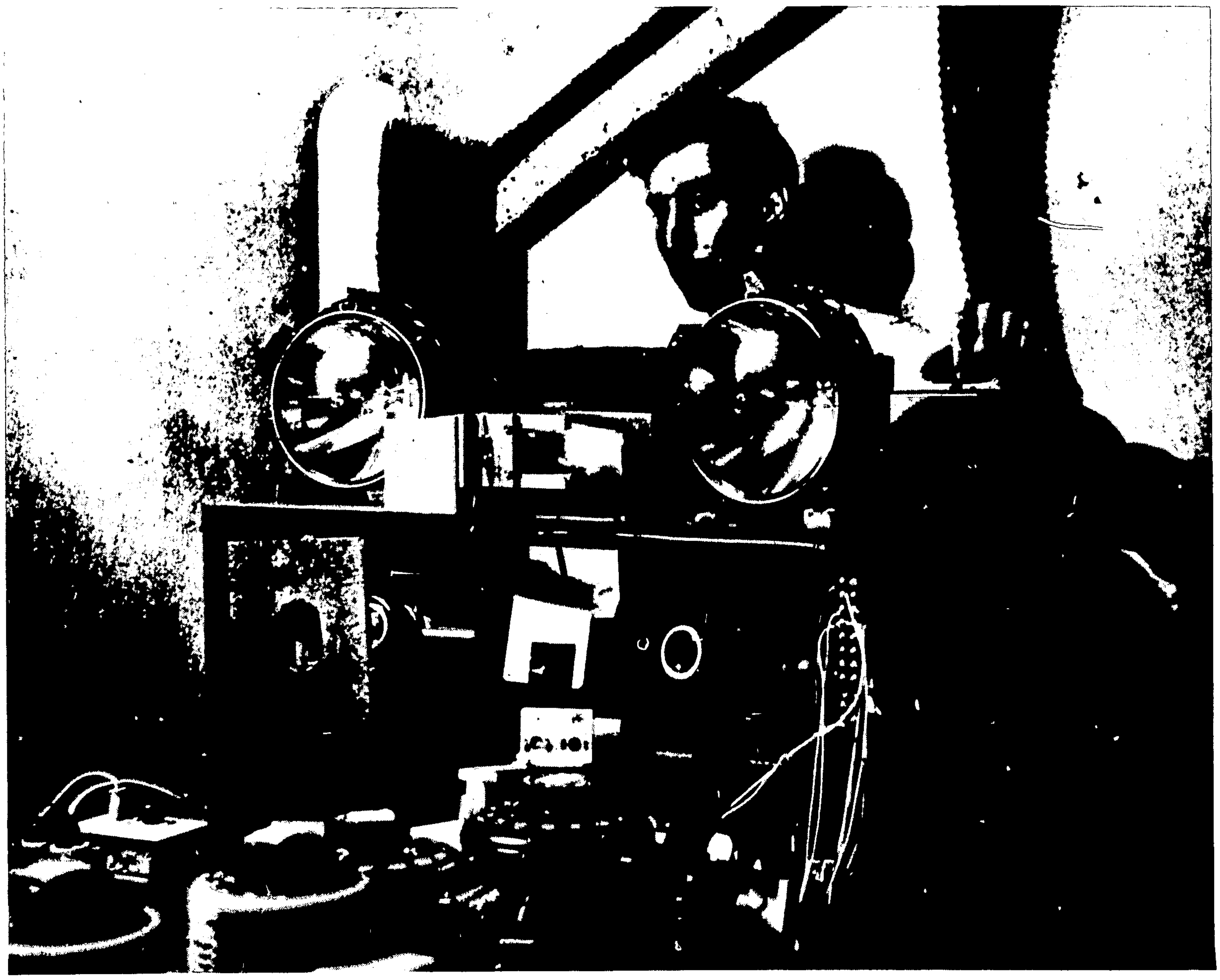
THIRD SERIES of Dr. Boynton's studies in which he tries to determine the time required to discover a square in a series of circles after brightness exposure is called the "running tau" experiment.

Observer (above) views translucent screen which operator (opposite page) illuminates either with high-powered spotlights or lower-powered projectors (under table). Device between spotlights projects objects onto screen.

luminance. Typical of this type of luminance change is the redirection of the eye from viewing a desk task to viewing a chalkboard task. Reaction is measured 3/10ths of a second later.

Analysis of results from the first group of studies indicated that there was little effect on visual performance when the change in luminance was 3-to-1 or less. Serious losses in immediate ability to see, however, occurred in luminance changes of 10-to-1 or more, up or down.

The second group of tests required that the eye be diverted from a seeing task to another level of luminance for periods ranging from 4/100ths of a second to 10 seconds before being returned to the original task.



Analysis of the results of these tests indicated that exposures of less than one second to a luminance 10 times greater than that of the working task did not noticeably affect visual performance. One-second exposures to luminances more than 10 times brighter than the task itself, however, produced serious losses.

The third type of study involved looking away from a 40-footlambert task to a field of higher luminance before turning back to the task to seek a square object among an assortment of circular objects.

Dr. Boynton's test compared the number of correct answers the subject gave after the sudden adaptation change with the number of correct answers given in the same response period when no adaptation change existed. The extent of loss due to the sudden adaptation change is indicated by the following example:

Following a one-second glance from a 40-footlambert to a 4000-footlambert field, the subject discovered the object 25 percent of the time as compared with 55 percent when there was no change in adaptation. Dr. Boynton is continuing with the same apparatus to measure visual performance.

# Standardized Test Objects

**PROJECT 70 AS 4&5**

Dr. Blackwell and his staff have been attempting to develop a field system to measure contrast losses in school and office printed and handwritten tasks. These losses are caused by reflections of overhead lighting units which veil the task. As reported last year, the team began by concentrating on handwriting samples and developed a technical device which produced standardized samples -- both pencil-dot and dragged (or written-out) handwriting samples. These samplings were studied under various distributions of light in a room 30' x 30' x 10'. Little difference in visibility was noted between the various fluorescent general lighting systems.

Next it was decided to introduce into the studies such extreme lighting conditions as concentrated downlight from reflector lamps and light from a luminous wall.

An important condition of the study was to retain the complexity and match the contrast losses existing in handwriting. Measurable results could not be achieved with existing equipment. The test site, therefore, had to be changed and new equipment brought in. This delayed the studies which have now been resumed.

The study also includes the measurement of losses in printed tasks.

Techniques for measuring the degree of loss have been successfully refined through the development of the Visual Task Photometer.

## Polarized Light

**PROJECT 78-66**

Dr. Robert P. Borofka and Prof. Philip E. O'Brien at the University of California at Los Angeles have been studying the use of polarized light for general room illumination in an effort to reduce reflected glare and to increase the contrast of typical visual tasks. In these studies, in an area that has attracted considerable professional interest in recent years, a technique was developed for measuring the degree of polarization of different parts of a visual task and for easy field use with a diversity of lighting conditions and tasks.

This is a photographic technique which allows many types of visual tasks to be recorded simultaneously, thereby making rapid orientation data collection possible. Three photographs are taken of a given task horizontally, vertically and an angle of $45^{\circ}$. Microdensitometer measurements can determine the degree of polarization for the corresponding locations in the scene.

Calibration tests indicate that, with this photographic technique, the degree of polarization can be determined to better than 3 percent. Measurements for these tests were made from newspapers, books and magazines which reflect substantial amounts of linearly-polarized light.

## Symposium

The fourth international symposium sponsored by the Illuminating Engineering Research Institute was held during the year at Ohio State University, Columbus, and was timed so that participants could also attend the quadrennial meeting of the International Commission on Illumination (C.I.E.).

Basic visual functions and practical lighting problems were examined and discussed by the participants in a series of presentations and open discussion periods.

Dr. R.A. Weale of London, reporting on his glare studies, contributed significantly to knowledge about the functioning of the eye by demonstrating that the scattering of light exists in the retina. Dr. J.J. Vos of Soesterberg, the Netherlands, confirmed that this phenomenon took place also in three other parts of the eye -- the cornea, lens and vitreous humor, as earlier studies indicated.

Dr. Pieter L. Walraven, also of Soesterberg, was among speakers who made multiple presentations. He discussed reasons why a given color frequently does not appear to the viewer to be the hue it actually is. He also reported on practical application of orange fluorescent light as a successful means of protecting roadway workers.

Dr. Werner K. Adrian of Karlsruhe, Germany, coordinated the views of Dr. H. Richard Blackwell and various German investigators on visual performance. He reported that only modest adjustment was needed in correlating numerical results because different test objects had been used.

Prof. Herbert A.W. Schober of Munich, Germany, told of studies in which he was able to relate poor refraction with poor performance among automobile drivers and factory workers.

In addition to these participants from England, Germany and the Netherlands, France and the United States were prominently represented on the list of speakers.

# ADMINISTRATIVE REPORT

During the 1966-67 period the following personnel administered the activities of the Institute:

**Board of Trustees**

John W. Ferree, Chairman
Alfred F. Wakefield, Treasurer
Edwin O. George
Clarence C. Keller
Everett M. Strong
Henry L. Wright

William P. Lowell, Jr.
deceased

**Research Executive Committee**

Leonard C. Mead, Chairman
Grant E. Davidson
Warren H. Edman
Glenn A. Fry
Charles D. Gibson
Arthur S. Tylor
Rolland M. Zabel

C. L. Crouch, Secretary

In addition, the Technical Advisory Committee on Light and Vision rendered its continuing recommendations and counsel to the Research Executive Committee and Trustees in planning the program, reviewing progress reports on each project and proposals for continuing and new research. The personnel of this Committee was as follows:

Glenn A. Fry, Chairman
Willard Allphin
Charles J. Campbell
Mason Crook
Benjamin H. Evans
Sylvester K. Guth
John J. Neidhart
Everett M. Strong

The Research Executive Committee held three meetings during the period, and the Technical Advisory Committee on Light and Vision two meetings. One of these was a joint meeting to review progress; the others were concerned with consideration of proposals and recommendations to the Trustees.

The Development Committee, consisting of the following members,

Robert G. MacDonald, Chairman
Walter Bouldin
Paul W. Emler
Edwin O. George
J. M. Hambley
Garlan Morse
Donald D. Scarff
C. A. Tatum, Jr.
Robert H. Wagner

met in September to consider a follow-up to the letter of solicitation which Mr. MacDonald had sent in the preceding spring to 168 public utility companies. Mr. Emler agreed to act as advisory counsel in developing a follow-up letter with the Secretary. Toward the end of the year Mr. Robert V. Corning, who succeeded Mr. Scarff as Vice President and General Manager of the Lamp Division, General Electric Company, took Mr. Scarff's place on the Development Committee.

The Trustees met once during the year. They reviewed the recommendations of the Research Executive Committee, and approved the proposed contracts for the following research projects:

Project 30A-67 Studies of Visual Performance - Field Factors
Dr. Stanley W. Smith
Ohio State University

| | | |
|---|---|---|
| Project 30B-67 | Studies of Visual Performance - Age<br>Mrs. O. M. Blackwell<br>Ohio State University |
| Project 47-67 | Illumination for Roadway Visual Tasks<br>Mrs. O. M. Blackwell<br>Ohio State University |
| Project 59-67 | Glare from Large-Area Sources<br>Dr. Ralph G. Hopkinson<br>University of London |
| Project 63-67 | Transitional Adaptation<br>Dr. Robert M. Boynton<br>University of Rochester |
| Project 80-67 | Discomfort Glare - Roadway Conditions<br>Y. K. Sze<br>Singapore Polytechnic |
| Project 81-67 | Veiling Reflections, Relation of Physically-Measured to Visually-Measured Contrast Loss<br>Professor Marion Currie<br>University of Toronto |
| Project 84-67 | Relation of Pupil Constriction to Discomfort Glare<br>Dr. Glenn A. Fry<br>Ohio State University |
| Project 85-67 | Relationship Between Illumination Levels and Accidents on Freeways<br>Paul C. Box |

The Project 59, Glare from Large-Area Sources, could not be continued at Cornell because of the retirement of Professor E. M. Strong. Negotiations for transferring the project to Tufts University were continued for some time, but lack of space finally prevented its acceptance there. In the meantime Dr. Ralph G. Hopkinson of the University of London was persuaded to further analyze the multi-glare source work done by William Atkinson at Cornell in 1965-66. He is to be aided in this work by Mrs. Wendy Collins.

A Newsletter issued during this period dealt with the acute need for skilled lighting engineers capable of applying the increasingly complex results of today's lighting research, and for teachers of illumination to train the engineers. Several speakers addressing a meeting of the Development Committee emphasized the rapid growth of all phases of the lighting industry, and the problems of meeting the corresponding demand for trained personnel. The Newsletter was mailed to a list of over 1400 persons.

The Secretary cooperated with the Joint Illuminating Engineering Society-American Society of Agricultural Engineers Committee to make Visual Task Evaluator measurements of poultry farm visual problems from the egg to the slaughterhouse, including the equipment involved. He served as a member of the traveling panel to the IES Regional Conferences to present the basis for the quantity and quality of the illumination recommended for schools.

He also attended meetings of the International Commission on Illumination in Washington, and participated as chairman of two sessions. He continues to serve as a member of the Metrology Panel of the National Academy of Science for review of the measurement activity of the National Bureau of Standards, of the Visibility Committee of the Highway Research Board, of the National Council on Schoolhouse Construction, of the Institute of Traffic Engineers, and of the Council of the American Association for the Advancement of Science.

# FINANCIAL REPORT

October 1, 1966 to September 30, 1967

| | |
|---|---|
| Balance on hand September 30, 1966 ................................................ | $ 19,652.49 |
| **Receipts** | |
| Illuminating Engineering Society | 60,000.00* |
| Contributions from utility companies | 53,925.78 |
| Personal contribution | 500.00 |
| Refund from Project 59-65 | 2,619.46 |
| Interest on savings account, Chase Manhattan Bank | 1,945.31 |
| Sale of annual report | 20.00 |
| Miscellaneous | 1.20 |
| Total receipts .................................. | $ 138,664.24 |

Disbursements

| Projects | 1966-67** | | Contract | Pd. in 1966-67 |
|---|---|---|---|---|
| 47-66 | Blackwell | Roadway | $ 2,425.00 | $ 2,425.00 |
| 48 | Helson | Color Pref. | | 907.42 |
| 59-66 | Atkinson | Discomfort Glare | | 63.00 |
| 63-66 | Boynton | Transitional Adaptation | 22,660.00 | 22,660.00 |
| | 1967-68 | | | |
| 30A-67 | Smith | Visual Performance | 22,060.00 | |
| 30B-67 | Blackwell | Ageing | 7,804.00 | |
| 47-67 | Blackwell | Roadway | 12,863.00 | |
| 59-67 | Hopkinson | Discomfort Glare | 3,200.00 | 200.00 |
| 63-67 | Boynton | Transitional Adaptation | | |
| 81-67 | Currie | Veiling Reflections | 4,255.00(U.S.) | |
| 84-67 | Fry | Discomfort Glare | 9,842.40 | |
| 85-67 | Box | Accident Study | 15,000.00 | |
| | | | | $ 26,255.42 |

| Accessory Services | | | |
|---|---|---|---|
| 59-AS4 | Marsh | Image Enhancement | $ 500.00 |
| 59-AS3 | Goodbar | Brightness Limitations | 500.00 |
| | | | $ 1,000.00 |

| Non-Project Expenses | Budget | |
|---|---|---|
| Travel - RX-TA Committee & Consultants | $ 2,000.00 | 2,687.92 |

| Administrative Expenses | | | |
|---|---|---|---|
| Public information (including PI consultant fees and expenses, Annual Report, Newsletters) | $ 3,500.00 | 4,753.08 | |
| Secretary's travel | 1,500.00 | 1,531.38 | |
| Services, stationery, photos, slides, etc. | 1,200.00 | 1,308.24 | |
| Development Committee and Research Symposium | | 1,227.23 | |
| | | $ 8,819.93 | |
| Total disbursements ................................ | | | $ 38,763.27 |
| Balance on hand September 30, 1967 ........................................ | | | $ 99,900.97 |

| Project Allocations to June 30, 1968 | | | |
|---|---|---|---|
| 30A-67 | Smith | Visual Performance | $ 22,060.00 |
| 30B-67 | Blackwell | Ageing | 7,804.00 |
| 47-47 | Blackwell | Roadway | 12,863.00 |
| 59-67 | Hopkinson | Discomfort Glare | 3,000.00 |
| 81-67 | Currie | Veiling Reflections | 4,255.00(U.S.) |
| 84-67 | Fry | Discomfort Glare | 9,842.40 |
| 85-67 | Box | Accident Study | 15,000.00 |
| | | | $ 74,824.40 |

*This does not include contributed services in the estimated amount of $10,000.
**Projects 30-66 and 78-66 were paid before the beginning of the fiscal year.